

SOME TERTIARY FOSSIL MOLLUSCS
FROM THE
ADELAIDEAN STAGE (PLIOCENE) OF SOUTH AUSTRALIA

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Plates xx-xxii.

INTRODUCTION.

WHILE working out the macrofauna of numerous water bores sunk in the Adelaide Plains by the Mines Department, for agricultural purposes and to provide water for pumping into the mains, a number of interesting molluscs were discovered. A few of these are described here; also some Abattoirs bore specimens selected by Sir Joseph Verco and myself from material donated to the South Australian Museum by H. S. Pratt in 1925. The latter specimens bear the inclusive registration number P. 173. A few also are described from the Salisbury Bore, 330 feet, from samples in the Tate Museum at the University of Adelaide.

Recent examination of material from the uppermost oyster beds at Mannum, Swan Reach and some other places along the River Murray cliffs, proves a similar suite of fossils to be present, with the dominant *Ostrea arenicola* and also *O. sturtiana*. These uppermost beds of the Murray Cliffs are probably exposures of the Adelaidean stage. From deep building excavations in the central city area, samples of the Adelaidean stage have been obtained. A rich bed of this deposit was found in the seepage well at the base of the Bank of New South Wales, King William Street, excavations at about 50 feet. A sample from there was found in the Mines Department. It contains the following typical Adelaidean fossils: *Mimachlamys antiaustralis*, *Equichlamys consobrinus*, *Equichlamys subbifrons*, *Spondylus spondyloides*, *Ostrea arenicola*, *Veletuceta subradians*, *Neodiastoma provisi*.

Samples from the same and other localities are in the South Australian Museum. Apparently this is a similar bed to that mentioned by Tate, 1883, in the Kent Town Bore "Series a" in which he records "oysters and pectens" as dominant. Incidentally, *Equichlamys consobrinus* and *E. subbifrons* both of Tate 1885, seem to be synonymous, *E. consobrinus* having priority, *E. subbifrons* being probably a juvenile. This Adelaidean deposit of fossils forms the principal porous bed in which the water of the aquifer is contained under the Adelaide Plains.

THE UPPERMOST BEDS OF THE MURRAY.

Species found in the bores and also recorded by Tate from his "Oyster banks of the Upper Murravian" are listed here. Those originally recorded from this bed in the Murray cliffs have the word (type) following the corrected name.

<i>Barbatia crustata</i> Tate (type).	<i>Antigona dictua</i> Tate (type).
<i>Pinctada crassicardia</i> Tate.	?= <i>Antigona pernitida</i> Hooper Woods
<i>Ostrea arenicola</i> Tate.	<i>Callanaitis paucirugata</i> Tate.
?= <i>Ostrea sturtiana</i> Tate (type).	?= <i>Callanaitis murrayana</i> Tate.
<i>Cardita compta</i> Tate.	(type).
<i>Venericardia pecten</i> Tate.	<i>Notocorbula ephamilla</i> Tate.
<i>Epicodakia affinis</i> Tate (type).	<i>Venerupis paupertina</i> Tate.
<i>Numella suborbicularis</i> Tate (type).	<i>Plebidonax depressa</i> Tate (type).
<i>Coriarius sericea</i> Tate.	<i>Myadora tenuilirata</i> Tate.
<i>Placamen subroboratum</i> Tate.	<i>Marginella propinqua</i> Tate.

To this list I can now add the following species also found in the uppermost beds of the Murray Cliffs. Many more species may be added when time and opportunity permit a palaeontological survey of the Murray Cliffs to be made and when a deeper study of the Tate Museum, South Australian Museum and Mines Department collections is undertaken.

- Neotrigonia trua* sp. nov. Recorded as *Trigonia acuticostula* McCoy.
- Eucrassatella* cf. *camura* Pritchard. Recorded as *Crassatella oblonga* Tenison Woods.
- Divalucina entypoma* sp. nov. Recorded as *Divaricella quadrisulcata* d'Orbigny.
- Zemysia solitaria* Hooper Woods. ?=*Diplodonta subquadrata* Tate.
- Cleidothaerus adelaidensis* sp. nov.
- Monia tatei* Chapman and Singleton. Recorded as *Placunomia ione* Gray.
- Mimachlamys antiaustralis* Tate.
- Tucetona crama* sp. nov. Recorded as *Pectunculus convexus* Tate.

THE UPPERMOST BEDS AT ALDINGA, HALLET COVE, EDITHBURGH, STANSBURY AND THE METROPOLITAN AREA.

The following species found in the bores have been recorded from Aldinga (A), Hallet Cove (H), Metropolitan Area "Oyster and pecten beds" (M), Edithburgh (E), Stansbury (S), Oyster beds, Government House Quarry (G).

- Equichlamys consobrinus* Tate. A. (type) H.
- ?=*Equichlamys subbifrons* Tate. G. (type).
- ?=*Equichlamys palmipes* Tate. E. (type) A.

- Mimachlamys antiaustralis* Tate. M. (type) A., E., S.
Spondylus spondyloides Tate. A. (type) H., M.
Amusium lucens Tate. A. (type).
Ostrea arenicola Tate. A. (type).
Atrina semicostata Tate. M. (type) A.
Brachyodontes submenkeana Tate. H. (type) A.
Venericardia trigonalis Tate. A. (type).
Epicodakia araea Tate. A. (type).
Epicodakia nuciformis Tate. A. (type).
Epicodakia fabuloides Tate. A. (type).
Wallucina simulans Tate. A. (type).
Kellia planiusculum Tate. A. (type).
 [*Tellina lata* Quoy and Gaimard, Recent Indo-Pacific] A.
Anapella variabilis Tate. A. (type).
Myadora corrugata Tate. G.
 [*Panopaea orbita* Hutton, New Zealand] A.
Lithodomus brevis Tate. H. (type).
Emozamia anceps Tate. A. (type).
Cymatiella sexcostata Tate. A. (type).
Cominella subfilicea Tate. A. (type) H.
Cominella clelandi Tate. H. (type).
Baryspira orycta Tate. A. (type).
Zemitrella mitrellaeformis Tate. A. (type).
Pervicacia crassa Tate. A. (type).

PELECYPODA.

PRONUCULA HEDLEY.

Pronucula Hedley 1902, Mem. Aust. Mus., 4, 290.

The Tertiary species *P. morundiana* and *P. fenestralis* Tate, belong to this genus judging from the development of the concentric and radial sculpture and the crenulated internal margin of the shell. An examination of the teeth and chondrophore should confirm this.

EUNUCULA Iredale.

Eunucula Iredale 1931, Rec. Aust. Mus., 18, No. 4, 202.

Genotype: *Nucula obliqua* Lamarek 1819. Recent, Southern Tasmania.

Recent: S.A., Vict., N.S.W., Q., W.A. Beach to 100 fathoms.

Fossil: Australia; Miocene. Pliocene. Pleistocene.

Remarks: The Recent European genotype of *Nucula*, *N. nucleus* Linne, differs from recent and fossil Australian *Eunucula* which the author of the genus pointed out has a "notably oblique chondrophore; above which the teeth become much smaller and the angle of opposition of the two rows of teeth is scarcely marked; further, the edge of the European shell is strongly denticulate, whereas ours is smooth." A complex group of Recent, shallow and deep water species belonging to this genus have been described, the localities ranging from New Guinea to Queensland, Victoria, South Australia and Tasmania. Many have been lumped under the familiar name *N. obliqua* Lamarek, a Southern Tasmanian living species.

ARCA NEGATA sp. nov.

Plate xx, figs. 11, 12.

Shell trapeziform, rounded in front, obliquely truncated posteriorly; hinge lines straight; umbones anterior, distant, acute; ventral margin with an almost median byssal gape; a sharp ridge runs from the umbo to the posterior ventral angle; anterior to the angle the sculpture consists of close fine radial ribs abruptly changing to less numerous wider radial ribs on the larger anterior portion. Height 11 mm., length 24 mm. (holotype).

Loc.: Bore 65, 385-395 feet, holotype, Adelaidean.

Remarks: This species, which may grow to twice the size of the holotype, somewhat resembles the Recent *Arca navicularis* Bruguiere 1792 from Amboina, related to *Arca subnavicularis* Iredale 1939 from North Australia. The Pliocene fossil here described as *A. negata* is nearest to *A. pseudonavicularis* Tate 1886 from the Adelaide Bore, Janjukian, but is differently sculptured. The new species is a true *Arca* according to Opinion 189 of the International Commission on Zoological Nomenclature which decided, "Under suspension of the rules:

(i) To set aside all type designations of *Arca* Linnaeus 1758, Syst. Nat. (Ed. 10) 1, 693 (Class Pelecypoda, Order Filibranchia), made prior to the date of this opinion;

and (ii) To designate *Arca noae* Linnaeus 1758, Syst. Nat. (Ed. 10) 1, 693, as the type of *Arca* Linnaeus 1758."

The genus *Navicula* Blainville 1825, introduced for the same genotype, has thus become a direct synonym, as does *Byssoarca* Swainson 1833, *Arca* Gray 1847, *Cibota* Moerch 1853, *Daphne* Poli 1791 (not Mueller 1776) and *Daphnoderma* Poli 1795.

Six Recent Australian species are described from Northern Australia.

Specimens recorded from the Adelaidean as *A. crustata* Tate 1886, described from the "Oyster Beds of the River Murray Cliffs at the North-west Bend" may be a smaller species related to *A. negata*.

BARBATIA EPITHECA sp. nov.

Plate xx, figs. 14, 17.

Shell irregularly subquadrangular, rather inflated, inequilateral; anterior end rounded; posterior side longer than the anterior, obliquely truncate and sharply rounded; ventral margin with a slight median sinuation; surface of valves sculptured with very fine and numerous radials crossed by almost equally developed concentrics; umbones moderately prominent, ligamental area narrow; height 12 mm., length 23 mm.

Loc.: Abattoirs Bore, holotype, Adelaidean.

Remarks: This species is related to the Recent *B. pistachia* Lamarek 1819 from King Island, Bass Strait (type) which is found living in southern Australia. *Barbatia limatella* Tate 1886, another allied species, was described from "Sandy Clays at Blanche Point, Aldinga Bay, and argillaceous glauconitic sands, Adelaide Bore." Tate's figured type is from "Adelaide" or Adelaide Bore, Janjukian, and is different from the Adelaidean species in shape and colour.

ACAR COMA sp. nov.

Plate xx, figs. 25, 26.

Shell subquadrangular, hinge line straight, umbones close, but slightly prominent; sculpture of concentric lamellae frilled radial, flattened ribs; ventral margin gently medially sinuate; anterior margin rounded, posterior angled and obliquely truncate; an obtusely angled ridge runs from the umbo to the posterior ventral angle. Height 10 mm., length 23 mm.

Loc.: Weymouth's Bore, 345-350 feet, Adelaidean.

Remarks: Related to *Barbatia celleporacea* Tate 1886 from Schnapper Point, Victoria (type), but differs in shape and sculpture, being also like the Recent *A. laminata* Angus 1865 from Gulf St. Vincent, S.A.

Other Recent species belonging to that genus are *A. divaricata* Sowerby (genotype), from Annaa Island, *A. reticulata* Gmelin=*A. domingensis* Larmarek, West Indian, *A. plicata* Dillwyn, Red Sea, *A. dubia* Baird, New Caledonia, *A. digna* Iredale, Lord Howe Island, *A. iota* Iredale, Low Island, Queensland, *A. botanica* Hedley 1916, Port Jackson, *A. kermu* Iredale, Kermadec Island.

CUCULLAEA PRAELONGA SINGLETON.

Cucullaea corioensis praelonga Singleton 1932. Proc. Roy. Soc., Vic., N.S. 44 (2), 303, pl. 26, fig. 20a, b.

The holotype is from Forsyth's, Grange Burn, near Hamilton, Victoria, Lower Pliocene, Kalimnan. Specimens are common in the Adelaidean, and appear to be this species, rather than *C. corioensis*. Singleton 1932 remarked that *C. praelonga* may grow to over 100 mm. in length. I have seen fragments of the Adelaidean shell suggesting even larger specimens than this. *Cucullaea corioensis* McCoy 1876 from Bird Rock Cliffs, near Spring Creek, Torquay, Janjukian, does not appear to survive beyond the Balcombian. *Cucullaea adelaidensis* Tate 1886 is still another species described from the Glauconitic Sands, Adelaide Bore, Aldinga.

FAMILY GLYCYMERIDAE.

Chapman and Singleton 1925, Proc. Roy. Soc. Vict., 18-60, pl. 1-4, revised the Tertiary Fossil *Glycymeris*. There are some thirty Recent and twenty Cainozoic species which may now be placed in their proper genera. The genotype of *Glycymeris* Da Costa 1778 is the Recent *Arca glycymeris* Linne, from the coasts of Britain and it is a large, almost smooth but transversely and longitudinally finely striate species ornamented with angular red spots. There is also a *Glycymeris* Schumacher 1817, a synonym of *Saxicava*. *Pectunculus* Lamarek 1799, used by continental authors of the past, is unavailable for this family, there being a previous *Pectunculus* Da Costa 1778 related to *Dosinia*. Australian Tertiary fossils may be grouped as follows:

Veletuceta Iredale 1931. Genotype *Glycymeris flammeus* Reeve.

striatularis (Lamarek) 1819. Recent W.A. (type) Kalimnan, Werrikoian.

subradians (Tate) 1902. Hallett Cove, Adelaidean.

halli (Pritchard) 1903. Grange Burn, Kalimnan.

mistio (Finlay) 1927. Not *intermedea* Broderip 1832.

=*intermedia* (Pritchard) 1903. Muddy Creek, Upper Beds, Kalimnan.

paucicostata (Pritchard) 1903. Jemmy Point, Kalimnan.

pseudaustralis (Singleton) 1941. Glenelg River, Werrikoian.

Tucetilla Iredale 1939. Genotype *Glycymeris capricornea* Hedley.

cainozoica (Tenison Woods) 1887. Table Cape, Janjukian.

maudensis (Chapman and Singleton) 1925. Maude, Lower Beds, Janjukian.

rota sp. nov. Abattoirs Bore, Adelaidean.

- Tucetona* Iredale 1931. Genotype, *Pectunculus flabellatus* Tenison Woods.
flabellatus (Tenison Woods) 1878; Recent, N.E. Tas. (type) Werrikoonian.
convexa (Tate) 1886. Muddy Creek, Upper Beds, Kalimnan.
crama sp. nov. Abattoirs Bore, Adelaidean.
subtrigonalis (Tate) 1886; Morgan, Janjukian.
decurrens (Chapman and Singleton) 1925. Grange Burn, Kalimnan.
- Melaxinaea* Iredale 1931. Genotype *Melaxinaea labyrinthica* Iredale.
planiuscula (Chapman and Singleton) 1925. Glenelg River, Werrikoonian.
- Grandaxinaea* Iredale 1931. Genotype *Glycymeris magnificans* Iredale.
maccoyi (Johnston) 1800. Table Cape, Janjukian.
ornithoptera (Chapman and Singleton) 1925. Torquay, Janjukian.
gunyoungensis (Chapman and Singleton) 1925. Grice Creek, Balcombian.
lenticularis (Tate) 1886. Adelaide Bore, Janjukian.
granti (Singleton) 1932. Muddy Creek, Lower Beds, Balcombian.
Glycymeris australis var. *gigantea* Chapman 1915, from Vivonne Bay, Kangaroo Island, Werrikoonian, belongs to the family *Lucinidae* as pointed out by Singleton, 1941.

TUCETILLA MAYI sp. nov.

Plate xx, figs. 18, 19.

Shell suborbicular, a little ovate and slightly produced at the posterior end; sculpture of fine and numerous radial riblets split as the shell grows into grouped secondary still finer threadlets; umbones subcentral, hinge teeth delicate, about ten on each side. Height 18 mm., diameter 20 mm.

Loc.: S.A. Beachport 100 fathoms (holotype), also 200 fathoms, Tas., Cape Pillar 100 fathoms, 40 fathoms.

Remarks: According to May, 1923, *Illust. Index Tas. Shells*, pl. 2, fig. 7, this species figured under the name *Glycymeris tenuicostatus* Reeve, from Cape Pillar, 100 fathoms, grows larger, but May's specimens in the South Australian Museum are little larger than the South Australian shells. May gave the depth for Tasmanian shells as "40-100 fathoms, not uncommon." The present series is more ovate and has finer sculpture than the North Queensland *Glycymeris tenuicostatus* Reeve 1843. The hinge teeth are less well developed than in either Reeve's species or in the fossil species described below.

TUCETILLA ROTA sp. nov.

Plate xx, figs. 3, 4.

Shell suborbicular, rather small, somewhat ventricose; sculpture of fine and numerous riblets and between each pair of major riblets secondary still finer

threadlets occur, increasing in number as the shell grows; umbones subcentral, hinge teeth fine, about twelve on either side. Height 19 mm., diameter 20 mm.

Loc.: Abattoirs Bore, holotype, Adelaidean.

The species is related to *T. mayi* rather than to *T. tenuicostata* Reeve, but it is rounder and more delicately sculptured than the Tasmanian species.

TUCETONA CRAMA sp. nov.

Plate xx, figs. 1, 2.

Shell solid, orbicular, slightly transverse, inequilateral; umbones approximate; radially ribbed; radial ribs narrow interspaces deeply furrowed; squamose concentric ornament; ribs numbering twenty-two rather flattened, inner margin of valves strongly crenate; cardinal teeth, about eight on each side. Height 30 mm., length 32 mm.

Loc.: Abattoirs Bore, holotype, Adelaidean.

Remarks: This species has been recorded from the Adelaidean as *Glycymeris convexus* Tate 1886, Muddy Creek, Upper Beds Kalimnan (type). Chapman and Singleton 1925 under *Glycymeris convexa* Tate, write: "Shells from the upper beds of the Adelaide Tertiary Basin as also in the Abattoirs and other bores, show a certain amount of variation from the Muddy Creek, topotypes, the South Australian examples being in general more depressed and with distinctly flattened ribs. The concentric ornament is also more developed as a series of undulose growth lines which cross the quadrately depressed ribs."

Two Recent South Australian species *T. flabellatus* and *T. broadfootae* resemble the present species which has a tendency to the deep radial interstitial furrows of *T. broadfootae*, but it is a much smaller and flatter shell.

PINCTADA CRASSICARDIA (Tate).

Meleagrina crassicardia Tate 1886. Trans. Roy. Soc., S. Aust., 8, 121, pl. 9, figs. 9, 10.

Large fragments of this species are common in the Adelaidean. The Recent *Pinctada carchariarium* Jameson 1901 from Sharks Bay is closely allied and is abundant as a raised beach subfossil at Murat Bay, South Australia. Six Recent species inhabit Northern Australia.

CTENAMUSIUM ATKINSONI (Johnston).

Amusium atkinsoni Johnston 1880. Proc. Roy. Soc. Tas. 29.

The holotype was described from Table Cape and it is distinct from *zitteli* Hutton 1873 "Upper Eocene," Poverty Bay, New Zealand, and the Recent

thetidis Hedley 1902. Specimens were picked out of the Salisbury Bore, 330 feet. Shells of the palaeartie genera *Propcamusium* Gregorio 1884, *Parramussium* and *Variamussium* are different from the Australian species such as *atkinsoni* which belong to *Utenamusium* Iredale 1929 and there are two Recent species, the genotype *C. thetidis* Hedley of Eastern and Southern Australia and the deeper water *C. calacon* Iredale 1929, of N.S.W.

OSTREA ARENICOLA Tate.

Ostrea arenicola Tate 1885. Trans. Roy. Soc. S. Aust., 8, 97, pl. 10, fig. 6.

The species was described from the Upper Aldinga series of Aldinga (Adelaidean) and is the common oyster and dominant shell of the Adelaide Bores, being plentiful in the aquifer. It is closely related to the Recent Port Lincoln Oyster *Ostrea sinuata* (= *angasi*) and to the Upper Pliocene, Werrikoian *Ostrea sinuata glenclgensis* Singleton 1941. This species is displayed in the Tate Museum at the University of Adelaide from the Abattoirs Bore as "*Ostrea sp.*" Like most species of *Ostrea*, it is variable and the "extreme variety" of *O. arenicola* mentioned by Tate from the "Upper Murravian" at the North-west Bend is probably the same species. It seems quite likely that *O. sturtiana* Tate from "the upper part of the River Murray Cliffs, from Overland Corner to beyond Blanchetown," is merely a senile form of *O. arenicola*, as its hinge development suggests. The narrow shape may be due to crowded conditions. The Recent *O. sinuata* when growing in clusters frequently becomes elongate and develops a longer ligamental area. Further study would be required to confirm this, but if the theory is correct, *O. sturtiana* has priority.

LOPHA HYOTIDOIDEA (Tate).

Ostrea hyotidoidea Tate 1899. Trans. Roy. Soc. S. Aust., 23, 268.

Tate first identified this fossil species as *Ostrea hyotis* Linne, which is a Recent tropical shell from the Indian Ocean and north Australia. He later renamed the fossil from the Murray River Cliffs, *O. hyotidoidea* Tate 1899. Both this and the Recent shell belong to the peculiar "Coxcomb" oysters classed under the genus *Lopha*. The fossil has been recorded from the Adelaidean, but so far I have not seen it in the bores examined.

NEOTRIGONIA TRUA sp. nov.

Plate xx, fig. 5-6.

Shell trigonal, compressed ribs, twenty eight, narrow set with close, fine lamellae; anterior margin convex, dorsal at first slightly convex, then concave and

later forming an abrupt angle with the convex ventral margin; hinge teeth striations about six on each of the two teeth. The shell is grey in the Adelaidean fossils with a silver-coloured naere preserved within. Height 25 mm. diameter 26 mm.

Loc.: Abattoirs Bore, holotype, Adelaidean.

Remarks: This species is related to the Recent *N. bednalli* Verco, but it is smaller and has finer lamellae on the radial ribs. It is less like *acuticostata* McCoy 1886 from Beaumaris—(Mordialloc) type locality of the "Cheltenhamian." *Eotrigonia* with its discrepant ornament of the Mesozoic species is represented by the genotype *Eotrigonia semiundulata* Jenkins in the Miocene beneath the Adelaidean of the Adelaide Plains.

CUNA APOREMA sp. nov.

Plate xx, fig. 7-8.

Shell rather thick, subtrigonal, sides slightly convex, umbonal angle rather less than a right angle; prodissoeoch minute and indistinct; cardinal and lateral teeth well developed; ventral border widely rounded, smooth, not crenulated or denticulated within or without, no radial sculpture, but there are coarse concentric, irregular incremental imbrications interspersed with microscopic incremental striae. Height 5 mm., diameter 4.25 mm.

Loc.: Bore 41, 405-407 feet, holotype, Adelaidean.

Remarks: This species is plentiful in the Adelaidean. The living species *Cuna solida* Cotton 1931 is somewhat similar in shape, but in no other respect, while the general features, smooth ventral margin and concentric sculpture recall the minute *Cuna cessens* Verco 1908. Of the Tertiary species, *Cuna polita* Tate 1887, from Muddy Creek, Lower Beds, is somewhat similar in shape, but *C. aporema* differs in its coarser sculpture and larger size.

EUORASSATELLA CAMURA (Pritchard).

Plate xx, figs. 15, 16.

Crassatellites camurus Pritchard 1903. Proc. Roy. Soc. Viet., 15 (2), 96, pl. 14, figs. 5, 9.

The shell found commonly in the Adelaidean is not quite like the Kalimnan species or the Miocene *oblonga* Tenison Woods 1876 from Table Cape. A specimen from the Abattoirs Bore is figured here. Height 45 mm., diameter 70 mm. It will be further studied when a more extensive series is available.

CARDITA COMPTA (Tate).

Mytilicardia compta Tate 1886. Trans. Roy. Soc. S. Aust., 8, 149, pl. 12, fig. 2.

An Adelaidean fossil has been listed from the Abattoirs Bore as *Cardita preissi* Menke 1843, which is a Recent shell from Western Australia, the name being a direct synonym of *Cardita incrassata* Sowerby 1825. Verco 1912 records it from Geraldton and Iredale 1914 from Montebello Island. The Adelaidean shell seems more nearly related to *Cardita compta* Tate, from Muddy Creek, Victoria.

EPICODAKIA SALEBROSA (Hooper Woods).

Codakia salebrosa Hooper Woods 1931. Trans. Roy. Soc. S. Aust., 55, 149, pl. 8, figs. 4, 5.

Specimens of this species are found in the Salisbury Bore 330 feet Adelaidean. The genus belongs to the family Lucinidae of which *Lucina* Lamarek 1799 has for the genotype *Lucina edentula* Linne from Jamaica. *Codakia* Scopoli 1777, genotype *C. orbicularis* Linne from West Africa was once used for the large Australian shells, now classed under *Pisocodakia*, genotype *Lucina rugifera* Reeve 1850 from New South Wales. The fossil species is related to *Epicodakia gunnamatta* from New South Wales and belongs to the same genus.

MILTHOIDEA HORA nom. nov.

Dosinia grandis Hooper Woods 1931. Trans. Roy. Soc. S. Aust., 55, 148, pl. 7, figs. 5, 6.

This name, given to a species described from the Abattoirs Bore, is preoccupied by *Dosinia grandis* Nelson 1870, Trans. Conn. Acad. Sci., 2, 201, from the Tertiary of Peru. The new name *Milthoidea hora* is introduced here for this large characteristic species of the Lucinidae.

DIVALUCINA ENTYPOMA sp. nov.

Plate xx, figs. 9, 10.

Orbicular, subinflated, moderately thick, with devaricate sculpture; the circular outline is truncate posteriorly and the umbones are at the angle and middle of the two dorsal margins which form an obtuse angle. Height 20 mm., diameter 20 mm.

Loc.: Abattoirs Bore, holotype, Adelaidean.

Remarks: The name *Divaricella quadrisculata* d'Orbigny 1847, Recent, West Columbia, was introduced into Australian Tertiary Mollusean nomenclature by

Tate 1886, but the fossil species is closely related to the South Australian Recent species *cumingi* Adams and Angas 1867, the genotype of *Divalucina* Iredale 1936, though differing in the fineness of the sculpture. *Divaricella* von Martens 1880, applied to a small Mauritius shell, *D. angulifera*, related to *Divaricella occidua* Cotton and Godfrey 1938 from Western and South Australia, has fine sculpture and notable lateral teeth not present in *Divalucina*. The specimen figured by Tate 1885, Trans. Roy Soc. S. Aust., pl. 12, fig 3, under the name *Lucina dentata* Wood from North West Bend, Oyster Beds, River Murray, is probably *D. entypoma*, as Tate incorrectly applied this name and *L. eburna*, Recent West Columbia to the fossil described here. Still another name used, but inapplicable, is *Lucina divaricata* Linne, originally described as *Tellina divaricata* Linne from the Mediterranean, but later figured by Reeve as *Lucina divaricata* Linne from "West Indies, Cape York, North Australia; Jukes." *L. divaricata* is the type of the genus *Lucinella* Montecasato 1883 and *dentata* Wood is regarded as a synonym. The genus is readily separated from *Divaricella* or *Divalucina* by the characteristic strongly dentate posterior edge. *Lucinella divaricata* is included in a recent list of British Marine Mollusca as *Divaricella divaricata* Linne, but the British authority, R. Winckworth, puts "*Quaerenda*" before the name and refers to Forbes and Hanley's "A History of British Mollusca and their Shells" and to Jeffrey's "British Conchology," for the record.

CLEIDOTHAERUS ADELAISENSIS sp. nov.

Plate xx, figs. 23, 24.

Shell rather solid, inequivalve, inequilateral; right valve deep and acutely keeled; attached by the anterior side which in the holotype is concave and bears the impression of the distinctive sculpture of *Prorichione cognata*; umbo anterior, subspiral; dorsal and posterior margin convex; anterior margin almost straight; sculpture of dense lamellae striae; interior nacreous; hinge resilifer subumbonal, shallow; adductor scars slightly unequal. Height 53 mm., diameter 55 mm.

Loc.: K. R. Weymouth's Bore, 450 feet, holotype, Adelaidean. Mines department material.

Remarks: The species is closely related to the Recent *Cleidothaerus albidus* Lamarek 1819 originally described from Tasmania and common in Southern Australia. The fossil species is thinner, has smaller adductor mussel impressions and less developed hinge features. The holotype is a right valve and I have not yet seen a left valve.

A related species was described as *Chamostrea crassa* Tate 1884 from Table Cape, Tasmania, Janjukian. Tate 1886 mentions a specimen from Muddy Creek,

Victoria, under the name *Chamostrca albida* Lamarek, Recent, Tasmania (type), the Southern Australian living species.

MYADORA ALEA sp. nov.

Plate xx, figs. 20, 21, 22,

Shell ovate, solid, anterior rounded, posterior truncate; right valve convex, overlapping the left all round; concentrically sculptured with about thirty slightly irregular ribs about half the width of the interspaces; a ridge runs from the umbo to the postero-ventral margin, becoming less marked towards the margin; left valve flat, less strongly sculptured and smaller. Height 15 mm.; diameter 19 mm.

Loc.: Salisbury Bore, 330 feet, holotype, Adelaidean, Tate Museum.

Remarks: Somewhat like the Recent *M. pervalida* Cotton 1931 from South Australia, but less strongly sculptured, fewer concentric ribs and less tapered posteriorly and smaller. *Myadora ovata* Reeve from the Philippines is differently sculptured.

GASTROPODA.

SOPHISMALEPAS ACRA sp. nov.

Plate xx, figs. 4, 5.

Shell thin, alongate-ovate, depressed; sides a little convex converging towards the anterior end, so giving the shell a tapered effect; anterior sharply rounded, posterior more widely rounded; orifice almost central, large, one-quarter the length of the shell, narrowly oval; sculpture of numerous fine radials, threads crossed by slightly weaker concentric threads with occasional spiral accremental lamellae; interior smooth, margin of shell flattened, internal margin of orifice having a narrow calloused border. Height 3 mm., diameter 14 mm. and 9 mm.

Loc.: Salisbury Bore, 330 feet, holotype, Adelaidean, Tate Museum.

Remarks: This is a more delicate shell than the Recent *S. nigrita* Sowerby 1834, described from South Tasmania, and it is quite different in shape.

TUGALIA NOTA sp. nov.

Plate xxi, figs. 11, 12.

Shell elongate ovate, elevated; protoconch sharp, at the posterior third; base arched, margin of shell crenulated within; front extremity sinuate, sculpture of numerous, fine radial riblets crossed by equally developed concentric riblets, the whole giving a close and regular fenestrate pattern; interior smooth with a groove

corresponding with the sinus running from the anterior margin to the apex. Height 5 mm., diameters 19 mm. and 11 mm.

Loc.: Abattoirs Bore, holotype, Adelaidean.

Remarks: This species is quite distinct from the Recent *T. cicatricosa* Adams 1851 originally described from South Australia. The fossil is an elevated shell without the cicatrix at the top and more like the large *T. parmaphoidea* Quoy and Garmand 1824, Recent, N.S.W. The only other *Tugalia* described from the Adelaidean is *T. infortunatum* Ludbrook, a minute species.

GENA INCOLA sp. nov.

Plate xxi, figs. 13, 14.

Shell elongate, subspiral ear-shaped, rather narrow, depressed; smooth except for accretional growth striae and numerous microscopical spirals; spire flattened, nearly hidden; aperture very large; columella margin concave, simple, a little reflected; outer lip convex, simple and thin. Height 3 mm., diameters 10 mm. and 16 mm.

Loc.: Salisbury Bore, 330 feet, holotype, Adelaidean, Tate Museum.

Remarks: Smaller and differently shaped from either the Recent *G. auricula* Lamarek 1816 of Southern Australia or *G. impertusa* Burrows 1815=*G. strigosa* Adams 1851 of New South Wales or *G. nigra* Quoy and Gainard 1834, of Queensland.

NINA ADELAIDENSIS sp. nov.

Plate xxi, figs. 17, 18.

Shell rather delicate, pyramidal; high and acutely conical; deeply umbilicated; whorls sharply angled; the angle set with comparatively produced, sharp, hollow spines; below the spinose angle of the body-whorl is a prominent nodulose spiral rib; the remaining sculpture consists of a few spaces, narrow, finely nodulose spirals; aperture round, columella simple. Height 16 mm., diameter 12 mm., diameter including last spine on body-whorl 15 mm.

Loc.: Salisbury Bore, 350 feet, holotype Adelaidean, Tate Museum.

Remarks: This remarkable species may belong to the monotypic genus *Nina* Gray 1850, the genotype of which is the *N. cumingi* Philippi from the Philippines and also taken in Queensland, "Caloundra" according to specimens in the South Australian Museum and also in Western Australia. The Tertiary fossil here described is a more delicate shell with a taller spire and wide umbilicus.

LATIAXIS DISSITUS sp. nov.

Plate xxi, figs. 9, 10.

Shell trigonal, spire depressed below the upper part of the body whorl; body whorl rather sharply roundly angulate at the top, the angle forming an obtuse keel set with a single row of large nodules increasing in size with the growth of the shell; sculpture of an unusual pattern of close wrinkled spirals; aperture rather small, narrowly ovate; canal long, narrow; umbilicus wide and deep, the outer margin weakly imbricate; whorls close, but in the unique specimen the body whorl near the aperture begins to show the first stage of separation from the spire whorls. Height 45 mm., diameter 39 mm.

Loc.: Abattoirs Bore, holotype, Adelaidean.

Remarks: The specimen, which is not quite adult, would probably measure say, 50 to 60 mm., in height when fully grown. Compared with the Recent Japanese genotype *L. mawae*, the present species is heavier, less strongly constructed in the middle, while the sculpture is peculiar and the spire of different formation. It bears a resemblance to some larger species of *Coralliophila*.

NOTOTEREERA gen. nov.

Genotype: *Terebra albida* Gray 1834. Recent, Victoria.

Shell ivory white, seldom brownish white, sometime with a row of small round subsutural brown spots; shell rather wide, whorls flat, suture subimpressed, with a depressed subsutural band scarcely visible in the earlier whorls, but becoming very marked in the later ones; whorls smooth, except for sinuous, oblique accretional striae which are sometimes, gathered into groups so as to form obsolete, very flat, low angular riblets, most valid just below the suture; protoconch of one-and-a-half whorls, slightly swollen, smooth and round.

Recent: Victoria, South Australia, Tasmania.

Fossil: Pliocene and Miocene of Australia.

Remarks: Species belonging to this genus are the Tertiary fossils, *T. simplex* Tenison Woods and *T. angulosa* Tate. The former is said to retain a suggestion of the colour spots sometimes seen in Recent specimens of *T. albida*.

UMBILIA CERA sp. nov.

Plate xxi, figs. 1, 2, 3.

Shell of small size for the genus, ovate; dorsum elevated; highest near to the posterior end, then convex to the anterior end; spire sunken into an umbilicus; anterior and posterior canal comparatively short, each slightly turned to the left;

aperture rather wide, well turned to the left posteriorly; outer lip broad with twenty-six teeth; columella side of aperture with twenty-two well-developed teeth. Height 55 mm., diameter 37 mm. and 27 mm.

Loc.: Abattoirs Bore, 320–410 feet, holotype, Adelaidean.

Remarks: The species is somewhat like the recent *U. beddomei* but quite distinct in the apertural features and in shape. The nearest fossil relative is probably *U. tatei* Cossman or *U. amygdalina* Tate 1890, from a "Well sinking in the Murray Desert," "Cheltenhamian." The present species is shorter, wider and higher and has more strongly developed teeth.

NOTOCYPRAEA ERYMA sp. nov.

Plate xxi, figs. 6, 7, 8.

Shell small, smooth and polished, pyriform; anterior extremity a little produced; aperture narrow, columella teeth fine, numerous short, not produced across the base; outer lip produced posteriorly in a characteristic curve, teeth fine, short, numerous; not umbilicate, spire not elevated, fossula moderately concave. Height 21 mm., diameter 13 mm. and 12 mm.

Loc.: Abattoirs Bore 320–410 feet, holotype, Adelaidean.

Remarks: The recent *N. piperita* is the nearest described species. The present species is smaller, with wider spaced teeth and slightly more produced.

UBER SUBJUGUM sp. nov.

Plate xxi, figs. 15, 16.

Shell large, thick, smooth, spire small, only slightly visible above the body whorl; aperture semicircular; columella callus thick and spreading, filling the posterior part of the aperture; widely and thickly spreading over the body whorl, almost covering the umbilicus; microscopic sculpture of spirals and normal growth striae. Height 30 mm., diameter 27 mm.

Loc.: Abattoirs Bore, holotype, Adelaidean.

Remarks: This species was recorded by Tate 1893 as *Natica gibbosa* Hutton from a "locality not actually known, but reported as a 'well-sinking in the Murray Desert.'"

Marwick, 1924, writes that "The disposition of the apertural callus is not the same as in the New Zealand species for it is much wider over the umbilicus than on the parietal wall, where it is relatively narrow." The length of the spire is rather variable in Adelaidean specimens. The correct name for the New Zealand species is *Uber huttoni* (von Ihering) 1907, the type being from Broken River, Treliassick Basin. *Polinices gibbosus* Hutton 1915 is a synonym.

CALLITRIPHORA gen. nov.

Genotype: Triforis wilkinsoni Tenison Woods 1879.

Shell elongate, pyramidal, turreted, thick, small, polished, with twelve sloping convex whorls, girdled with four lines of granules; suture slightly canaliculate; protoconch three whorls; smooth and rounded; aperture quadrate, base flattened, with one groove and radiately striate; canal short.

Distribution: Miocene Pliocene.

Remarks: The holotype specimen of *C. wilkinsoni* comes from Muddy Creek (Lower Bed). The shell is more turreted than Recent Australian species and the protoconch is unique in having three smooth whorls. The fossil occurs in the Adelaidean.

COTTONIA HANNAFORDI (McCoy).

Voluta hannafori McCoy. Prod. Pal. Vict., Dec. 1, 23, pl. 6, fig. 1.

This species originally described from the Lower Beds of Muddy Creek, was found in the Miocene below the Adelaidean in some bores. Other species belonging to the genus are the Tertiary *C. validicostata* Tate = *C. alticostata* Tate, *C. stephensi* Johnson and *C. heptagonalis* Tate. Recent species are *C. dannevigii* Verco (genotype) and *C. nodiplicata* Cox. A closely-allied volute is the Recent *Mamillana mamilla* Gray or False Melon Shell. These remarks are made here because the genus *Livonia*, strictly confined to a West Atlantic area, has been used in connection with some of those Australian shells, with which it has relation whatever. *Livonia* Gray 1858, is a synonym of *Aurina* H. and A. Adams 1853, having the same genotype *Voluta dubia* Broderip 1928, a species of doubtful standing. Maxwell Smith 1942, designated *Aurina dohrni dohrni* Sowerby of Florida, as genotype. Other synonyms of *Aurina* are *Maculopeplum* Dall 1906, and *Volutifusus* Conrad 1862, none of which have any similarity with the Australian Recent and Tertiary species which belong to *Cottonia*.

NOTOVOLUTA TATEANA (Johnston).

Voluta tateana Johnston 1879. Proc. Roy. Soc. Tas., 37.

This Table Cape fossil, or one related to it, occurs in the Adelaidean in the Salisbury Bore 330 feet, and the Abattoirs Bore. The species belongs to *Notovoluta* Cotton 1946, genotype *Voluta kreuslerae* Angas, and other Recent species belonging to the genus are *veronis* Cotton, *perplicata* Hedley. Tertiary fossil species are *U. cathedralis* Tate, *U. pagoloides* Tate and *tabulata* Tate.

EXPLANATION OF PLATES.

Plate xx.

- Fig. 1. *Tucetona crama* sp. nov., exterior $\times 1.2$.
 Fig. 2. *Tucetona crama* sp. nov., interior $\times 1.2$.
 Fig. 3. *Tucetilla rota* sp. nov., exterior $\times 1.4$.
 Fig. 4. *Tucetilla rota* sp. nov., interior $\times 1.4$.
 Fig. 5. *Neotrigonia trua* sp. nov., exterior $\times 1.2$.
 Fig. 6. *Neotrigonia trua* sp. nov., interior $\times 1.2$.
 Fig. 7. *Cuna aporema* sp. nov., exterior $\times 6.3$.
 Fig. 8. *Cuna aporema* sp. nov., interior $\times 6.3$.
 Fig. 9. *Divalucina entypoma* sp. nov., exterior $\times 1.7$.
 Fig. 10. *Divalucina entypoma* sp. nov., interior $\times 1.7$.
 Fig. 11. *Arca negata* sp. nov., dorsum $\times 1.2$.
 Fig. 12. *Arca negata* sp. nov., interior $\times 1.2$.
 Fig. 13. *Arca negata* sp. nov., exterior $\times 1.2$.
 Fig. 14. *Barbatia epitheca* sp. nov., interior $\times 1.7$.
 Fig. 15. *Eucrassatella camura* Pritchard, exterior $\times 0.4$.
 Fig. 16. *Eucrassatella camura* Pritchard, interior $\times 0.4$.
 Fig. 17. *Barbatia epitheca* sp. nov., exterior $\times 1.7$.
 Fig. 18. *Tucetilla mayi* sp. nov., exterior $\times 1.4$.
 Fig. 19. *Tucetilla mayi* sp. nov., interior $\times 1.4$.
 Fig. 20. *Myadora alea* sp. nov., left valve $\times 1.7$.
 Fig. 21. *Myadora alea* sp. nov., right valve interior, holotype $\times 1.7$.
 Fig. 22. *Myadora alea* sp. nov., right valve, exterior, holotype $\times 1.7$.
 Fig. 23. *Cleidothacrus adelaidensis* sp. nov., exterior $\times 0.4$.
 Fig. 24. *Cleidothacrus adelaidensis* sp. nov., interior $\times 0.4$.
 Fig. 25. *Acar coma* sp. nov., exterior $\times 1.2$.
 Fig. 26. *Acar coma* sp. nov., interior $\times 1.2$.

Plate xxi.

- Fig. 1. *Umbilia cera* sp. nov., dorsum $\times 0.9$.
 Fig. 2. *Umbilia cera* sp. nov., ventrum $\times 0.9$.
 Fig. 3. *Umbilia cera* sp. nov., lateral view $\times 0.9$.
 Fig. 4. *Sophismalepas aera* sp. nov., dorsum $\times 2.3$.
 Fig. 5. *Sophismalepas aera* sp. nov., ventrum $\times 2.2$.
 Fig. 6. *Notocypraea eryma* sp. nov., dorsum $\times 1.4$.
 Fig. 7. *Notocypraea eryma* sp. nov., ventrum $\times 1.4$.
 Fig. 8. *Notocypraea eryma* sp. nov., lateral view $\times 1.4$.
 Fig. 9. *Latiaxis dissitus* sp. nov., ventrum $\times 0.9$.
 Fig. 10. *Latiaxis dissitus* sp. nov., dorsum $\times 0.9$.
 Fig. 11. *Tugalia nota* sp. nov., dorsum $\times 1.8$.
 Fig. 12. *Tugalia nota* sp. nov., ventrum $\times 1.8$.
 Fig. 13. *Gena incola* sp. nov., dorsum $\times 3.2$.
 Fig. 14. *Gena incola* sp. nov., ventrum $\times 3.2$.
 Fig. 15. *Uber subjubum* sp. nov., dorsum $\times 0.9$.
 Fig. 16. *Uber subjugum* sp. nov., ventrum $\times 0.9$.
 Fig. 17. *Nina adelaidensis* sp. nov., ventrum $\times 1.8$.
 Fig. 18. *Nina adelaidensis* sp. nov., dorsum $\times 1.8$.

Plate xxii.

- Fig. 1. Sample of Adelaidean Pliocene material from 50 feet beneath the surface in the Bank of New South Wales Building excavations.
 Fig. 2. Another view of the Adelaidean material shown above.